

**Translation**

**PATENT COOPERATION TREATY**

PCT/EP2003/010867



**PCT**

**INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY**  
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference <b>2002P12385WO</b>	<b>FOR FURTHER ACTION</b> See Form PCT/IPEA/416	
International application No. <b>PCT/EP2003/010867</b>	International filing date ( <i>day/month/year</i> ) <b>01 October 2003 (01.10.2003)</b>	Priority date ( <i>day/month/year</i> ) <b>16 October 2002 (16.10.2002)</b>
International Patent Classification (IPC) or national classification and IPC <b>H03K 7/08</b>		
Applicant <b>SIEMENS AKTIENGESELLSCHAFT et al</b>		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets, including this cover sheet.

3. This report is also accompanied by ANNEXES, comprising:

a. ☐ (sent to the applicant and to the International Bureau) a total of \_\_\_\_\_ sheets, as follows:

☐ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).

☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.

b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) \_\_\_\_\_, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒ Box No. I Basis of the report

☐ Box No. II Priority

☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

☐ Box No. IV Lack of unity of invention

☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

☐ Box No. VI Certain documents cited

☐ Box No. VII Certain defects in the international application

☐ Box No. VIII Certain observations on the international application

Date of submission of the demand <b>06 April 2004 (06.04.2004)</b>	Date of completion of this report <b>06 April 2005 (06.04.2005)</b>
Name and mailing address of the IPEA/EP	Authorized officer
Facsimile No.	Telephone No.

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

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Box No. I Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

- ☐ This report is based on translations from the original language into the following language \_\_\_\_\_, which is language of a translation furnished for the purpose of:
- ☐ international search (under Rules 12.3 and 23.1(b))
  - ☐ publication of the international application (under Rule 12.4)
  - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

- ☒ The international application as originally filed/furnished
- ☒ the description:
- pages \_\_\_\_\_ 1-22 \_\_\_\_\_, as originally filed/furnished
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- ☒ the claims:
- pages \_\_\_\_\_ 1-15 \_\_\_\_\_, as originally filed/furnished
- pages\* \_\_\_\_\_, as amended (together with any statement) under Article 19
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- ☒ the drawings:
- pages \_\_\_\_\_ 1-5 \_\_\_\_\_, as originally filed/furnished
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- ☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, Nos. \_\_\_\_\_
- ☐ the drawings, sheets/figs \_\_\_\_\_
- ☐ the sequence listing (*specify*): \_\_\_\_\_
- ☐ any table(s) related to sequence listing (*specify*): \_\_\_\_\_

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, Nos. \_\_\_\_\_
- ☐ the drawings, sheets/figs \_\_\_\_\_
- ☐ the sequence listing (*specify*): \_\_\_\_\_
- ☐ any table(s) related to sequence listing (*specify*): \_\_\_\_\_

\* If item 4 applies, some or all of those sheets may be marked "superseded."

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/EP 03/10867

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement****1. Statement**

Novelty (N)	Claims	1-15	YES
	Claims		NO
Inventive step (IS)	Claims	1-15	YES
	Claims		NO
Industrial applicability (IA)	Claims	1-15	YES
	Claims		NO

**2. Citations and explanations**

1. This report makes reference to the following documents:

D1: US 5 506 484

D2: US 5 227 961

2. Both figure 7 of D1 and figure 2a of D2 show the following features of independent claims 1 and 10:

a device (D1: 1102) for generating multichannel pulse width-modulated rectangular pulses, precisely one pulse being emitted within a period at each channel, the inception of a pulse relative to an inception moment being delayed by an actual dead time (D1: 1104), and the dead time being kept constant in each case for at least one period.

On the other hand, the following features of the independent claims are neither disclosed nor suggested by the available prior art within the meaning of PCT Article 33:

- and, in order to modulate the pulse width, the control system is arranged so as to generate a new value for the dead time and/or a new value for the period duration and

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to set the actual dead time and/or the actual period duration at the beginning of the desired period to the new value of the dead time and/or the period duration.

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## Patent claims

1. Method for producing two-channel or multi-channel pulse-width modulated rectangular pulses (Aa, Ab, Ac; Ba, Bb, Bc),  
5 in which, within a period (PE) exactly one pulse is discharged in each channel, and the inception of a pulse in relation to the moment of inception ( $t_0$ ,  $t_3$ ,  $t_5$ ,  $t_7$ , ... ;  $t_1$ ,  $t_2$ ,  $t_3$ ,  $t_4$ ,  $t_5$ ,  $t_6$ ) is delayed by an actual dead time ( $t_d$ ), the dead time ( $t_d$ ) is kept constant for at least one  
10 period in each case,  
characterized in that, for a modulation of the pulse width (PW, PW') a new value for the dead time ( $t_d'$ ) is produced and the current dead time ( $t_d$ ) is set at the beginning of the desired period to the new value of the dead time ( $t_d'$ ).  
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2. Method according to Claim 1,  
characterized in that two consecutive pulses in different channels are each separated from each other in time by a current dead time.  
20
3. Method according to Claim 1 or 2,  
characterized in that the new value of the dead time ( $t_d'$ ) is buffered independently of the current value of the dead time ( $t_d$ ) and the current value is overwritten with the new value  
25 at the beginning of the desired period.
4. Method according to one of the Claims 1 to 3,  
characterized in that the dead time is set to the new value ( $t_d'$ ) at the beginning of each period.  
30
5. Method according to one of the Claims 1 to 4,  
characterized in that the maximum pulse width for a channel is set to the duration of the period divided by the number of the channels.  
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6. Method according to Claim 5,  
characterized in that, with two channels, the maximum pulse  
width is set to half the duration of a period.

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7. Method according to one of the Claims 1 to 6,  
characterized in that, with n channels, after the duration of  
the pulse width has elapsed for the maximum pulse width for  
the first to the (n-1) channel, an interrupt signal (rset) is  
10 created and the beginning of the dead time for the next chan-  
nel is shown.

8. Method according to Claim 7,  
characterized in that, at the end of a period an interrupt  
15 signal (set) is generated, with which the beginning of the  
dead time for the first channel or the beginning of a new  
period is marked.

9. Method according to Claim 8,  
20 characterized in that the overwriting of the current dead  
time with the new value for the dead time is initiated with  
the interrupt signal (set).

10. Device for executing a method according to one of the  
25 Claims 1 to 9,  
characterized in that it features two dead time registers,  
one Dead Time Master Register (DTM) and one Dead Time Slave  
Register (DTS), and that the new value for the dead time  
(td') is buffered independently of the current value of the  
30 dead time (td) stored in the Dead Time Slave Register (DTS).

11. Device according to Claim 10,  
characterized in that it is set up to overwrite the value  
stored in slave register (DTS) with the value buffered in a

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master register (DTM) at the beginning of the desired period.

12. Device according to Claim 11,  
characterized in that it is set up to overwrite the value  
5 stored in slave register (DTS) with the value buffered in a  
master register (DTM) at the beginning of each period.